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| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|----------------------------|-------------|----------------------|---------------------|------------------|
| 10/767,406                 | 01/28/2004  | Ares J. Rosakis      | 14850-004001        | 2854             |
| 20985                      | 7590        | 06/04/2007           | EXAMINER            |                  |
| FISH & RICHARDSON, PC      |             |                      | LEE, HWA S          |                  |
| P.O. BOX 1022              |             |                      | ART UNIT            | PAPER NUMBER     |
| MINNEAPOLIS, MN 55440-1022 |             |                      | 2886                |                  |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/767,406             | ROSAKIS ET AL.      |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Andrew Hwa S. Lee      | 2886                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 27 December 2006.
- 2a) This action is FINAL.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-62 is/are pending in the application.
- 4a) Of the above claim(s) 39-62 is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-38 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All    b) Some \* c) None of:
    1. Certified copies of the priority documents have been received.
    2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO/SB/08)  
 Paper No(s)/Mail Date \_\_\_\_\_
- 4) Interview Summary (PTO-413)  
 Paper No(s)/Mail Date \_\_\_\_\_
- 5) Notice of Informal Patent Application
- 6) Other: \_\_\_\_\_

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Bard et al (US 6,717,681).

Bard et al. (Bard hereinafter) show high-resolution phase stepping shearography comprising:

providing a substrate (“sample” in Figure 9) having opposing front and back surfaces, the surfaces having corresponding positions.

using an optical probe beam (laser light, column 5, lines 25+) with a substantially uniform wavefront to illuminate at least one surface selected from the front and back surfaces produce a reflected probe beam with a reflected wavefront that carries distortions caused by an illuminated area on the at least one surface;

directing the reflected probe beam (column 5, lines 41+) through an optical shearing interferometer device (column 5, lines 44+) to obtain an optical interference pattern between the reflected wavefront and another replica of the reflected wavefront that is spatially shifted by a shearing distance;

Art Unit: 2886

adjusting a phase shift (column 5, lines 52+) between the reflected wavefront and the replica of the reflected wavefront to obtain a plurality of phase-shifted interference patterns of different phase shifts from the optical shearing interferometer; and

processing (column 7, lines 49+) the interference patterns to obtain information on surface slopes of at least one portion of the front surface, the at least one portion being or corresponding to the illuminated area.

3. Claim 20 is rejected under 35 U.S.C. 102(b) as being anticipated by Pouet et al (US 5,481,356).

Pouet et al (Pouet hereinafter) show an apparatus for phase-modulating interferometry comprising:

providing a substrate ("sample" in Figure 9) having opposing front and back surfaces, the surfaces having corresponding positions.

a collimated radiation source (1, 51, 53) to produce a collimated probe beam onto a surface under measurement (19);

an optical shearing interferometer (59, 61, 63) device positioned to receive the optical probe beam reflected from the surface and to cause an optical interference between a reflected wavefront of the optical probe beam and another replica of the reflected wavefront that is spatially shifted by a shearing distance, wherein the optical shearing interferometer is operable to adjust a phase shift (37, 61) between the reflected wavefront and the replica of the reflected wavefront to obtain a plurality of phase-shifted interference patterns of different phase shifts;

an imaging device (CCD camera) to capture the interference patterns produced by the optical shearing interferometer; and

a processing device (65, 67) to process the interference patterns captured by the imaging device to extract information on surface slopes across the illuminated area in the surface under measurement.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

Art Unit: 2886

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosakis et al (US 6,031,611) in view of Bard.

With respect to claims 1 and 20, Rosakis et al. (Rosakis hereinafter) show a coherent gradient sensing method and system comprising:

providing a wafer having opposing front and back surfaces, the surfaces having corresponding positions.

using an optical probe beam with a substantially uniform wavefront to illuminate at least one surface selected from the front and back surfaces to produce a reflected probe beam with a reflected wavefront that carries distortions caused by an illuminated area on the surface;

directing the reflected probe beam through an optical shearing interferometer device to obtain an optical interference pattern between the reflected wavefront and another replica of the reflected wavefront that is spatially shifted by a shearing distance; and

processing the interference patterns to process the interference patterns captured by the imaging device to extract information on surface slopes of the at least one portion of the front surface, the at least one portion being or corresponding to the illuminated area.

Rosakis does not show the adjusting a phase shift between the reflected wavefront and the replica of the reflected wavefront to obtain a plurality of phase-shifted interference patterns of different phase shifts from the optical shearing interferometer.

Art Unit: 2886

Bard et al. (Bard hereinafter) show high-resolution phase stepping shearography wherein Bard teaches that phase stepping in shearography is beneficial since it results in increased signal-to-noise ratio (SNR), increased displacement resolution (resulting in increased flaw detection sensitivity), quantitative rather than qualitative results, and other factors. Therefore, one of ordinary skill in the art would have modified the method of Rosakis so that phase stepping is performed order to improve SNR and resolution.

With regards to claim 2 and 21, Rosakis shows a coherent gradient sensing (CGS) system with diffraction gratings as the optical shearing interferometer in Figure 1.

With regards to claims 3-5 and 22-24 Bard teaches that there are more than seven known optical shearing mechanisms, and more than six known phase-stepping methods. Official Notice is taken that radial and bi-lateral shearing and using prisms, are well known in the art, and at the time of the invention, one of ordinary skill in the art would have used either radial or bi-lateral shearing for each are functional equivalents in that the wavefront is sheared and recombined for interference and each have advantages and disadvantages and it would have been within the skill level of the artisan to select the preferred method of shearing such as radial (one wavefront magnified relative to another)<sup>3</sup> since lateral shearing can cause background radiation interference to overlap and obscure the desired image.

With regards to claims 6 and 25, it would have been obvious to shift the phase in the claimed increments as one of ordinary skill would recognize that the more images obtained at different

Art Unit: 2886

phase steps, the better ability there is to improve resolution and a skilled artisan would have incremented the phase steps evenly from 0 to 360 degrees depending on the desired number of phase steps. See Horwitz et al (US 4,575,248) for example where the phase is shifted in 90 increments.

With regards to the algorithms of claims 7-19 and 26-38, Bard teaches that there are at least 10 different known algorithms, and Official Notice is given that the claimed algorithms are well known for phase unwrapping the images and would have used the claimed algorithms in order to resolve the interference images to the surface profile of the sample being measured.

#### *Response to Arguments*

8. Applicant's arguments filed 12/27/07 have been fully considered but they are not persuasive. Applicant argues that the cited references do not show or suggest the features as now claimed. The examiner respectfully disagrees. Rosakis shows a wafer as a sample to be measured. A wafer will have a front and back surface. In figure 6, Rosakis shows the front surface of the wafer being illuminated and measured.

#### *Conclusion*

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

Art Unit: 2886

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew Hwa S. Lee whose telephone number is 571-272-2419. The examiner can normally be reached on Tue-Fr.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley Jr. can be reached on 571-272-2800 ext 77. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Andrew Hwa Lee  
Primary Examiner  
Art Unit 2877